

THE LARVAL DEVELOPMENT OF *LITORIA BREVIPALMATA* (ANURA:HYLIDAE)

MARION ANSTIS

Anstis, M. 1994 12 01; The larval development of *Litoria brevipalmata* (Anura:Hylidae). *Memoirs of the Queensland Museum* 37(1): 1-4, Brisbane, ISSN 0079-8835.

The tadpole of *L. brevipalmata* is unique amongst Australian hylid frogs of the pond dwelling nektonic type in possessing a median vent tube. The embryo is one of a small number of species so far known to have three pairs of external gills. □ *Anura, Hylidae, Litoria brevipalmata, embryonic and larval development.*

M. Anstis, 26 Wideview Rd, Berowra Heights, New South Wales 2082, Australia; 5 January 1994.

Litoria brevipalmata Tyler, Martin & Watson, 1972 is the sole member of the *Litoria brevipalmata* species group of Tyler & Davies (1978). A medium-size, ground-dwelling species, it is readily distinguished from congeners by the combination of a rich brown dorsal colour and pale green in the axilla, groin and posterior surface of the thighs.

The type description was based on a series of adult frogs collected at Durimbah Ck near Gosford, NSW, and Byaburra (near Wauchope) NSW, but no information on life history was presented. McDonald (1974) reported its occurrence at Ravensbourne and Crows Nest National Parks in SE Queensland, and the frog was found subsequently at Jimna, 80km north of these localities (Czechura, 1978) and in the Kilcoy Shire (McEvoy et al., 1979). Barker & Grigg (1977) stated that large numbers of males were calling after rain in a flooded paddock near Gosford (late October, 1972), and noted that juveniles were collected during April in wet sclerophyll forest.

Two more recent records are now known from near Woogaroo Ck near Wacol, Brisbane (Natrass & Ingram, 1993). This is the only published coastal locality so far for the species. However, in the summer of 1993/1994 there have been further records from Marsden, Karawatha, Beerwah and Nambour (G. Ingram, pers. comm.)

The present paper describes the only available embryo and larval material.

MATERIALS AND METHODS

The following description is based on an egg mass from one pair of frogs collected by H.G. Cogger on 29 October, 1972. The pair was taken from beside a permanent pond in a paddock near Ourimbah Ck, Gosford NSW after heavy rain and amplexus occurred in a plastic bag. The eggs were laid during the evening of 30 October. Most embryos died in transit. One was preserved at stage 9, five at stage 17, one at stage 20 (just hatched), one tadpole at

each of stages 37 and 41 and one newly metamorphosed at stage 46. Specimens are lodged in the Australian Museum (AMR118482, AMR118483).

Tadpoles were raised in an outdoor container of pond water experiencing variable water temperatures (16-25°C), and were fed on boiled lettuce. Tadpoles were anaesthetised in Chlorbutol solution, then embryos and tadpoles preserved in Tyler's (1972) Fixative. Specimens were measured with a vernier caliper to 0.01mm, or an ocular micrometer attached to a stereoscopic microscope. The staging system is that of Gosner (1960).

Abbreviations for larval measurements (Table 1) refer to Altig (1970), Anstis (1976) and McDiarmid & Altig (1989) as follows:

In lateral view: TL = total length; BL = body length; BD = max. body depth; TD = max. tail depth; TM = depth of tail musculature (in line with TD); BTD = tail depth at body terminus; BTM = depth of tail musculature at body terminus; E = eye diameter; S = diameter of spiracle at opening; SN = snout to naris; SE = snout to eye; SS = snout to spiracular opening; DF = max. depth of dorsal fin; VF = max. depth of ventral fin.

In dorsal view: BW = max. body width across abdomen; EBW = width of body at level of eyes; BTMW = max. width of tail musculature at body terminus; IO = inter-orbital span; IN = inter-narial span; EN = distance from eye to naris.

In ventral view: MW = transverse width of oral disc.

Illustrations were drawn using a drawing tube attached to the stereoscopic microscope.

DESCRIPTION OF EMBRYOS

The single female laid 556 eggs. It was not possible to make observations on the form of the egg mass, as a result of disturbance during transit. Ova were at stage 9 when first observed on 1 November, 1972. One embryo preserved at this stage had a dark brown animal pole, off-white vegetal pole and measured 2.02mm in diameter.

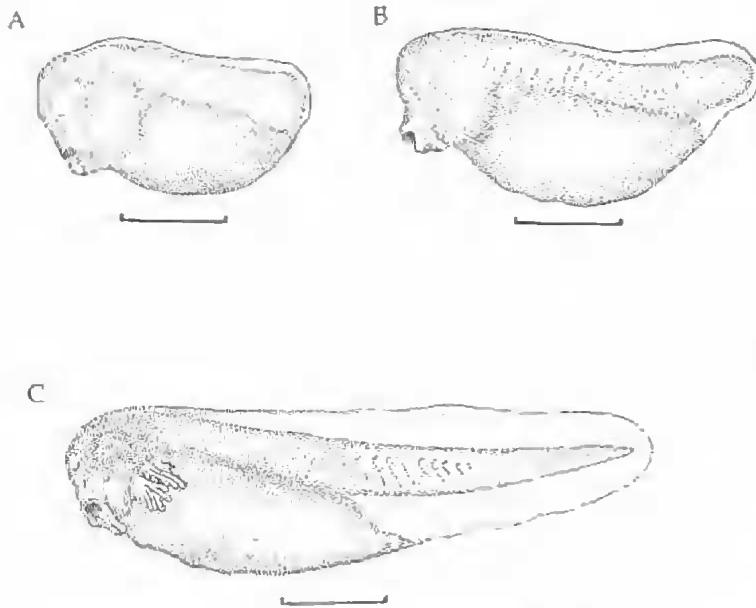


FIG. 1. Embryological stages of *L. brevipalmata*. A, early stage 17; B, stage 18; C, stage 20. Scale bars = 1mm.

By 2030 on 1 November, the embryos had reached stage 17. The tail bud is bent in this stage, making most measurements of embryo length approximate.

Embryos preserved at early stage 17 (Fig. 1A), have optic bulges, prominent gill plate bulges, a slight pronephric swelling and fine, closely aligned muscular ridges along the neural tube. There are prominent U-shaped ventral suckers joined by the stomodaeal groove. The embryos are pale brown with a pale cream yolk sac. There are a small number of melanophores around the gill plate and neural tube, and the ventral suckers are heavily pigmented.

An embryo at stage 18 has very prominent gill plate bulges (Fig. 1B). The stomodaeal groove is deeply furrowed, its rim protruding strongly forward. There is a small oral sucker at each corner. The optic bulge is quite indistinct and the tail fins are beginning to develop. The embryo is very pale cream in preservative.

The first specimen hatched at stage 20 on 2 November, 3 days after the eggs were laid. The live embryo is dark grey-brown with a light brown yolk sac. The optic region is barely discernable and the oral suckers are prominent, being still joined along the anterior edge of the stomodaeal groove, and divided medially on the posterior edge. The indis-

tinct narial pits are faintly outlined with pigment. There are three pairs of external gills; 3 branches on the uppermost pair, 7 on the middle pair and 8 on the lowest (Fig. 1C). The tail musculature ridges are developing and the fins are translucent.

DESCRIPTION OF LARVAE

The only larvae available for study were one specimen at stage 37 and one at stage 41. The former specimen (Fig. 2) is described as follows:

Body ovoid in shape, widest across mid-region of abdomen. Snout broad and truncate in dorsal view and truncate in lateral view. Nares small, opening antero-laterally and outlined by a fine border of melanophores. Eyes lateral. A narrow ridge

runs from from each eye to each naris. Spiracle sinistral, ventro-lateral, not visible from above, opening postero-dorsally, with tube diameter decreasing markedly from origin to opening. Vent tube broad, median in position and opening to a diamond-shape when expanded. When relaxed, the aperture has a '<' shape, with point of '<' directing anteriorly (Fig. 2C). Opposite point of diamond-shaped opening (>) attached to edge of ventral fin.

Tail fins arched, tapering to a fine point. The dorsal fin extends onto the body up to the mid-point of the abdominal region (Fig. 2B) and in lateral view, fin is deepest just anterior to its mid-point. Ventral fin marginally deepest anterior to its mid-point. Tail musculature deepest at body terminus, then narrows, before broadening slightly near mid-point and tapering to a fine flagellum.

Oral disc antero-ventral, bordered by small marginal papillae around all but medial anterior third. A small number of submarginal papillae present. Labial teeth in two complete anterior and three complete posterior rows, each set approximately equal in length (Fig. 3). Keratinised jaw sheaths narrow, with fine serrations along the somewhat irregular inner edges.

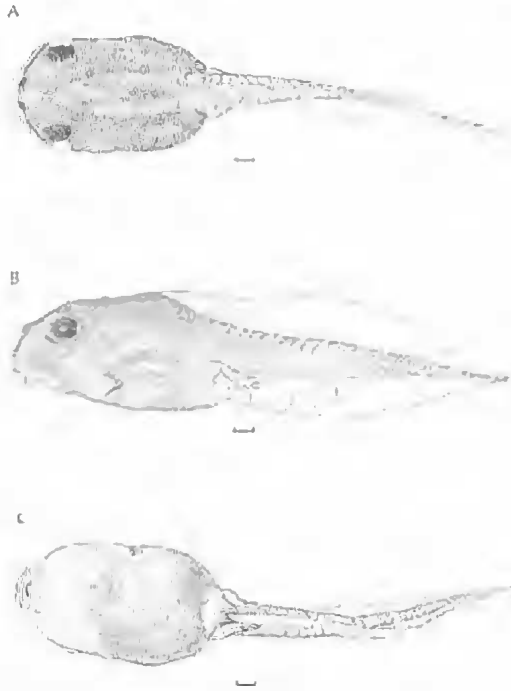


FIG. 2. Larva of *L. brevipalmata* at stage 37. A, dorsal view; B, lateral view showing cream internarial patch visible only in life; C, ventral view. Scale bars = 1 mm.

COLOUR IN LIFE

Dorso-lateral surface uniform dark brown, with a small cream patch on snout between nares (Fig. 2A). Dorsal surface of tail musculature dark anteriorly, lightening posteriorly. Ventrolateral surface with a grey blue sheen. Fins mostly transparent, with some light sandy pigment along the tail musculature in lateral view. Cream patch on snout barely distinguishable on specimen at stage 41.

COLOUR IN PRESERVATIVE

Dorsal surface of specimen at stage 37 dark brown (darkest over the intestines), but cream patch has disappeared. Tail musculature only slightly lighter than body anteriorly, becoming pale cream posteriorly. Hind limbs show some patches of melanophores.

Ventro-lateral region over intestinal mass mainly dark blue-grey, with part of intestine and fore-limb visible. Remainder of body dark brown, except for translucent region around vent. Fins and musculature have fine dusky pigment diffused over entire surface, increasing slightly towards body terminus. Musculature bordered

above and below by fine line of pigment. Specimen at stage 41 has more pigment over tail and body, and body wall is slightly less translucent.

Ventral surface dark blue/grey over intestines and anterior half translucent, with fine, diffuse pigment.

Metamorphosis was reached on 26 December 1972, 57 days after the eggs were laid. One specimen preserved immediately at stage 46 was 12.7 mm in length and shows the uniform brown of the adult over dorsum and limbs. The white labial stripe is present and there is a black canthal stripe from tip of snout to eye. A similar stripe is just beginning in the post-orbital region above the tympanum. At $\times 6$ power, numerous scattered, fine tubercles cover the dorsum. The ventral surface is white. The green pigment present in the axilla, groin and thighs of the adult, as yet has not developed.

DISCUSSION

EMBRYOLOGICAL DEVELOPMENT

L. brevipalmata is unusual in possessing 3 pairs of external gills. Only one other Australian hylid species has been described as having 3 pairs (*L. chloris*, see Watson & Martin, 1979).

LARVAE

The tadpole of *L. brevipalmata* is the only lentic, nektonic Australian hylid species yet described as possessing a median vent tube. Prior to about stage 41, live tadpoles may be distinguished from other sympatric ground-dwelling

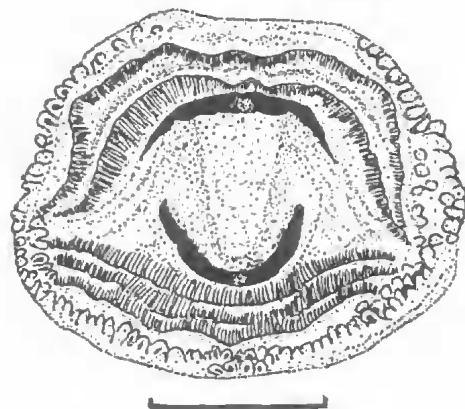


FIG. 3. Mouthparts of *L. brevipalmata* larva at stage 37. Scale bar = 1 mm.

TABLE 1. Measurements in mm. A, embryos; B, larvae; C, metamorphosis.

A. Embryos		
Stage	No.	Diameter
9	1	2.02
17	5	2.7 (2.59-2.88)
18	1	3.32
20	1	5.33
B. Larvae (Specimens per stage = 1)		
Lateral View	Stage 37	Stage 41
TL	28.9	29.4
BL	11.15	10.66
BD	6.23	5.9
TD	6.72	6.07
TM	2.13	2.13
BTD	5.74	NA
BTM	2.79	2.62
E	1.48	1.48
S	0.66	0.57
SN	0.82	0.49
SE	2.29	1.97
SS	6.16	5.9
DF	2.54	2.79
VF	2.46	1.97
Dorsal View		
BW	6.4	6.23
EBW	6.15	5.9
BTMW	2.62	1.97
IO	3.61	3.61
IN	1.48	1.31
EN	1.8	1.80
Ventral View		
MW	2.71	2.30
C. Metamorphosis (Specimens per stage = 1)		
	Stage 46	
TL	12.7	

hylid species such as *L. freycineti*, *L. latopalmata* (Anstis, unpubl.), *L. nasuta* (see Tyler et al., 1983) and *L. lesueuri* (see Martin et al., 1966) by a combination of a uniform dark brown body colour, a small cream patch on the snout, median vent tube opening and two unbroken anterior rows of labial teeth.

ACKNOWLEDGEMENTS

Acknowledgement is made to the Australian Museum for the loan of specimens, and to

Stephen J. Richards and Jean-Marc Hero of the Department of Zoology, James Cook University for helpful suggestions on the manuscript.

LITERATURE CITED

- ALTIG, R. 1970. A key to the tadpoles of the United States and Canada. *Herpetologica* 26: 180-207.
- ANSTIS, M. 1976. Breeding biology and larval development of *Litoria verreauxi* (Anura: Hylidae). *Transactions of the Royal Society of South Australia* 100: 193-202.
- BARKER, J. & GRIGG, G. 1977. 'A field guide to Australian frogs'. (Rigby: Adelaide).
- COGGER, H.G. 1975. 'Reptiles and amphibians of Australia'. (Reed: Sydney).
- CZECHURA, G.C. 1978. A new locality for *Litoria brevipalmata* (Anura: Pelodyadidae) from South-Eastern Queensland. *Victorian Naturalist* 95: 150-151.
- GOSNER, K.L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* 16: 183-190.
- MARTIN, A.A., LITTLEJOHN, M.J. & RAWLINSO, P.A. 1966. A key to anuran eggs of the Melbourne area, and an addition to the anuran fauna. *Victorian Naturalist* 83: 312-314.
- McDIARMID, R.W. & ALTIG, R. 1989. Description of a bufonid and two hylid tadpoles from Western Ecuador. *Alytes* 8: 51-60.
- McDONALD, K.R. 1974. *Litoria brevipalmata*. An addition to the Queensland amphibian list. *Herpetofauna* 7 (1): 2-4.
- McEVOY, J.S., McDONALD, K.R. & SEARLE, A.K. 1979. Mammals, birds, reptiles and amphibians of the Kilcoy Shire, Queensland. *Queensland Journal of Agriculture and Animal Sciences* 36: 167-180.
- NATTRASS, A.E.O. & INGRAM, G.J. 1993. New records of the rare Green-thighed frog. *Memoirs of the Queensland Museum* 33: 348.
- TYLER, M.J., CROOK, G.A. & DAVIES, M. 1983. Reproductive biology of the frogs of the Magela Creek system, Northern Territory. *Records of the South Australian Museum* 18: 415-440.
- TYLER, M. J. & DAVIES, M. 1978. Species groups within the Australopapuan hylid frog genus *Litoria* Tschudi. *Australian Journal of Zoology, Supplementary Series* 63: 1-47.
- TYLER, M.J., MARTIN, A.A. & WATSON, G.F. 1972. A new species of hylid frog from N.S.W. *Proceedings of the Linnaean Society of New South Wales* 97: 82-86.
- WATSON, G.F. & MARTIN, A.A. 1979. Early development of the Australian green hylid frogs *Litoria chloris*, *L. fallax* and *L. gracilema*. *Australian Zoologist* 20 (2): 259-268.